King County Climate Change Impacts Worksheet

The SEPA Checklist requires a project proponent to estimate the air emissions that will result from the project. King County asks project proponents to include greenhouse gas emissions in that estimate. This worksheet will assist project proponents in providing this information.

Greenhouse gas emissions to the air that may result from a development proposal include carbon dioxide, methane, nitrous oxide, and fluorinated gases. These emissions occur during the manufacture and transportation of materials used in the development, during construction, and during operation of the development upon completion. For additional information on greenhouse gas emissions, the types of activities that can generate greenhouse gases, see http://epa.gov/climatechange/emissions/index.html.

If using recycled materials (such as recycled steel) or biofuels (such as biodiesel) please note this. However, do not try to quantify the decrease in emissions that using these materials provides.

The categories below (upstream, on site, and downstream) capture the primary emission sources for their life cycle or overall emissions impact. The GHG multiplier is based upon carbon dioxide equivalents (CO_2e) and is explained in the endnotes.

GHG emissions created in the manufacturing of construction materials ("upstream")

Cement.
Estimate the number of pounds of cement used in constructing all phases of the project. Note: a typical sack of cement that is used in concrete is about 95 pounds but its weight can vary.

Cement: _____ pounds X 0.97 pounds CO_2e /pound cement [1] = _____ pounds CO_2e

Iron or Steel.
Estimate the number of pounds of iron or steel used in all phases of the project. Please include all steel rebar used on concrete. Note one short ton of steel is 2000 pounds.

Iron or Steel: _____ pounds X 1.75 pounds CO_2e /pound iron or steel [2] = _____ pounds CO_2e

GHG emissions created during construction of the project ("on site")

Estimate the amount of fossil fuel consumed during construction for all vehicles, machinery, and heavy equipment.

Diesel: _____ gallons X 26.55 pounds CO_2e /gallon [3] = _____ pounds CO_2e

Gasoline: _____ gallons X 24.30 pounds CO_2e /gallon [3] = _____ pounds CO_2e

GHG emissions from the on-going energy use associated with the project ("downstream")

Estimate the annual consumption of fossil fuel at the project site when the project is completed.

Transportation

Automobile: _____ vehicle trips/year X 7.39[4] X 0.051gallon gasoline/mile[5] X 24.30 pounds CO_2e /gallon gasoline[3] = _____ pounds CO_2e/year

Energy

Electricity:

Seattle City Light electricity service territory: zero emissions.

Puget Sound Energy electricity service territory:

Residential: _____ # housing units X 7,622 kwh/housing unit[6] X 1.01 pounds CO_2e /kwh[7] = _____ pounds CO_2e

Commercial/Industrial:
_____ total sq. ft X 13 kwh/sq. ft[8] X 1.01 pounds CO2e/kwh = _____ pounds CO_2e

If heating is provided by natural gas, then:

Residential: _____ # housing units X 480 therms/housing unit[9] X 12.0593 pounds CO_2e/therm[10] = _____ (pounds CO_2e)

Commercial/Industrial:
_____ total sq. ft. X 0.297 therms/sq. ft[11]. X ~ 12.0593 pounds CO_2e/therm = _____ pounds CO_2e

	(pounds CO_2e)
Total:	
Cement:	_____
Iron or Steel:	_____
Diesel:	_____
Gasoline:	_____
Electricity:	_____
Natural Gas:	_____
Total	_____

Proposed measures to reduce greenhouse gas emissions
See http://epa.gov/climatechange/wycd/index.html for suggestions. Also, see, the Massachusetts Environmental Policy Act Office Greenhouse Gas Emissions Policy and Protocol at http://www.mass.gov/envir/mepa/pdffiles/misc/ghgemissionspolicy.pdf.

References

[1] Cement manufacturing is the largest non-energy industrial source of CO_2 emissions. There are two primary sources of GHG emission related to cement production. The first source is the emissions created by fuel combustion to heat minerals in the industrial kilns that combine to form cement "clinker.". This combustion creates approximately ~ 46% of production emissions. The remaining ~ 54% of emissions are from the conversion of limestone to lime in the industrial kilns which directly emits large amounts of CO_2. Other emissions factors NOT included are emissions created from mining and transporting virgin materials for cement production.

Hanle, L. CO_2 Emissions Profile of the U.S. Cement Industry. Available: http://www.epa.gov/ttn/chief/conference/ei13/ghg/hanle.pdf

[2] The Iron and Steel emission factor "calculates direct GHG emissions (CO_2) from oxidation of the reducing agent, from the calcination of the flux used in steel production, and from the removal of carbon from the iron ore and scrap steel used" (http://www.wri.org/climate/pubs_content_text.cfm?cid=2524). This emissions factor assessment does NOT include emissions created from mining and transporting necessary materials for steel and iron production.

GHG Protocol., CO_2 emissions from the production of iron and steel, Appendix B: http://www.ghgprotocol.org/DocRoot/gZ5rm4pPJgCpIFjvOGSd/co2-iron.xls

[3] The CO_2 emissions estimates for gasoline and diesel include the extraction, transport, and refinement of petroleum as well as their combustion.

Life-Cycle CO_2 Emissions for Various New Vehicles. RENew Northfield. Available: http://renewnorthfield.org/wp-content/uploads/2006/04/CO2%20emissions.pdf

[4] PSRC Travel Model Documentation .Updated for Congestion Relief Analysis. Table 7.4 Summary of Trip Distribution Results. Available: http://www.psrc.org/data/tdmodel/model_doc(draftfinal).pdf

[5] This is the weighted national average fuel efficiency for all cars and 2 axle, 4 wheel light trucks in 2005. This includes pickup trucks, vans and SUVs. The 0.051 gallons/mile used here is the inverse of the more commonly known term "miles/per gallon" (which is 19.75 for these cars and light trucks).

Transportation Energy Data Book. 26th Edition. 2006. Chapter 4: Light Vehicles and Characteristics. Calculations based on weighted average MPG efficiency of cars and light trucks. Available: http://cta.ornl.gov/data/tedb26/Edition26_Chapter04.pdf

[6] This is the average kwh of energy used for the 16.6 million housing units in the Pacific Census region (Washington, Oregon and California).

Total Energy Consumption in U.S. Households by West Census Region, 2001. Pacific Region Physical Units of Total Consumption per Household, Fuels Used. Available: http://www.eia.doe.gov/emeu/recs/recs2001/ce_pdf/enduse/ce1-12c_westregion2001.pdf

[7] Based on calculations defined by 2006 PSE fuel mix data provided by the WA State Department of Community, Trade & Economic Development (CTED).

[8]Electricity Consumption and Conditional Energy Intensity by Census Division for Non-Mall Buildings, 2003: Part 3. Pacific Region (WA, OR, CA). All buildings (excluding malls), per square foot.. Available: http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set10/2003pdf/c19.pdf

[9] Physical Units of Total Consumption per Household, Fuels Used. Total Energy Consumption in U.S. Households by West Census Region, 2001. Pacific Region (WA, OR, CA). Available: http://www.eia.doe.gov/emeu/recs/recs2001/ce_pdf/enduse/ce1-12c_westregion2001.pdf

[10] Fossil Fuel Conversion Factors. US Department of Energy, Energy Information Agency. Available: http://www.eia.doe.gov/oiaf/1605/factors.html.

[11] Natural Gas Consumption and Conditional Energy Intensity by Census Division for Non-Mall Buildings, 2003: Part 3. Pacific Region (WA, OR, CA). All buildings, per square foot. Available: http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set11/2003pdf/c29.pdf